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Modelling of Laser Pendant Droplet Formation and Determination of Laser Pulse

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Abstract

In laser droplet formation process, a melted metal droplet is produced by heating the tip of the metal wire by laser beams. Laser droplet formation consists of two phases: the formation of a molten pendant droplet and droplet detachment. First phase of the process is of special importance for determination of droplet properties as droplet diameter, heat content and temperature distribution. With the aim of finding suitable process parameters for pendant droplet formation we built a theoretical and numerical model of the process. The model enables the simulation of a three-dimensional temperature field of the wire at different process parameters and calculations of the amount of melted material. In the presented investigation the model and selected minimum vaporisation criterion were used for theoretical determination of the laser power pulse at selected velocity profiles. The obtained theoretically determined laser power pulse and corresponding wire feed velocity profile yielding the highest amount of melted material was verified experimentally. With respect to the obtained experimental outcomes of the process the pulse derived from the model is found to be the most appropriate for the pendant droplet formation.